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27-DAY VARIATIONS OF THE GEOMAGNETIC FIELD DISTURBANCE ON ZERO DAYS OF COSMIC RAY INTENSITY

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SUMMARY

This paper studies the interconnection of the 27-day variations of cosmic rays and of the geomagnetic field. Comparing the data obtained with those of some previous works, the authors conclude that 1) the 27-day variations of K_p- indices are less clearly expressed than the 27-day variations of cosmic rays, 2) the 27-day variations of the H-component of equatorial stations reflect about the same pattern of variations as the 27-day variations of K_p- indices, 3) a clear correlation is observed between the 27-day variation of the geomagnetic field variation in the aurora zone and the 27-day variations of cosmic rays. The solar wind's most sensitive indicator, quite adequate to cosmic rays, is thus the characteristic of geomagnetic field disturbance in the aurora zone.

* * *

At the present time an increasing number of facts are evidence that the 27-day variations of cosmic rays are linked with the solar wind asymmetry, the magnetic field irregularities, with the rotation of this asymmetry with the Sun and with the dynamics of galactic cosmic ray sweep out of the interplanetary space by a quasiradial flow of magnetic inhomogeneities. Direct measurements on Mariner-2 confirmed the existence of the 27-day asymmetry in the solar wind. On the other hand, the solar wind action is particularly clearly manifest at high latitudes [2, 3].

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* 27-DNEVNYYE VARIATSII VOZMUSHCHENNOSTI GEOMAGNITNOGO POLYA PO NUL'-DNYAM INTENSIVNOSTI KOSMICHESKIKH LUCHEY.

At the same time, while plasma flux exerts its action upon the geomagnetic field, the galactic cosmic rays are mainly the object of action of magnetic fields' motion. How are these two most important characteristics of the solar wind interconnected? An answer to this question can be obtained by studying the interconnection of the 27-day variations of cosmic rays and of the geomagnetic field.

It was shown in [4, 5], according to data from the world network of cosmic ray stations, that during the IGY there existed in the course of 9 — 10 Sun's revolutions a region of active longitudes, that was found to be the cause of the 27-day variations of cosmic rays. However, the effect of Sun's rotation was not equally clearly reflected on all the parameters characterizing the solar-terrestrial relationships. It was found, in particular, by way of comparison of diagrams, plotted by zero-days of planetary intensity of the neutron component of cosmic rays, that the 27-day variations are most clearly manifest in the mean-daily values of cosmic ray intensity. It became clear, that the values of planetary intensity of cosmic rays constitute objective physical characteristics of the states of electromagnetic conditions in interplanetary medium, that is, they apparently reflect most precisely the motion characteristics of magnetic inhomogeneities in various directions from the Sun.

In order to bring forth the reflections of solar rotation effect in the variations of the geomagnetic field for the past solar activity maximum, the world net of geomagnetic stations was divided into eight latitude zones : 0—25° N, 0—25° S, 25— 55° N, 25—55° S, 55—65° N, 55—65° S, 65—90° N, 65—90° S.

For the analysis the basic method, consisting in plotting the diagrams for the values of K-indices, averaged by these zones, and also of planetary characteristics of the geomagnetic field disturbance for K_p [6, 7], was used. Selected for zero days were those of planetary intensity of the neutron component of cosmic rays of the first four months of the IGY

Shown in Fig. 1 are the diagrams for the 27-day variations of the planetary disturbance of the geomagnetic field by the K_p-index, the 27-day variations of the K-index (K_{av}) by averaged values of 17 selected

stations, and also the difference in the diagrams of mean values of K of northern and southern stations ($K_{av}^{N} - K_{av}^{S}$).

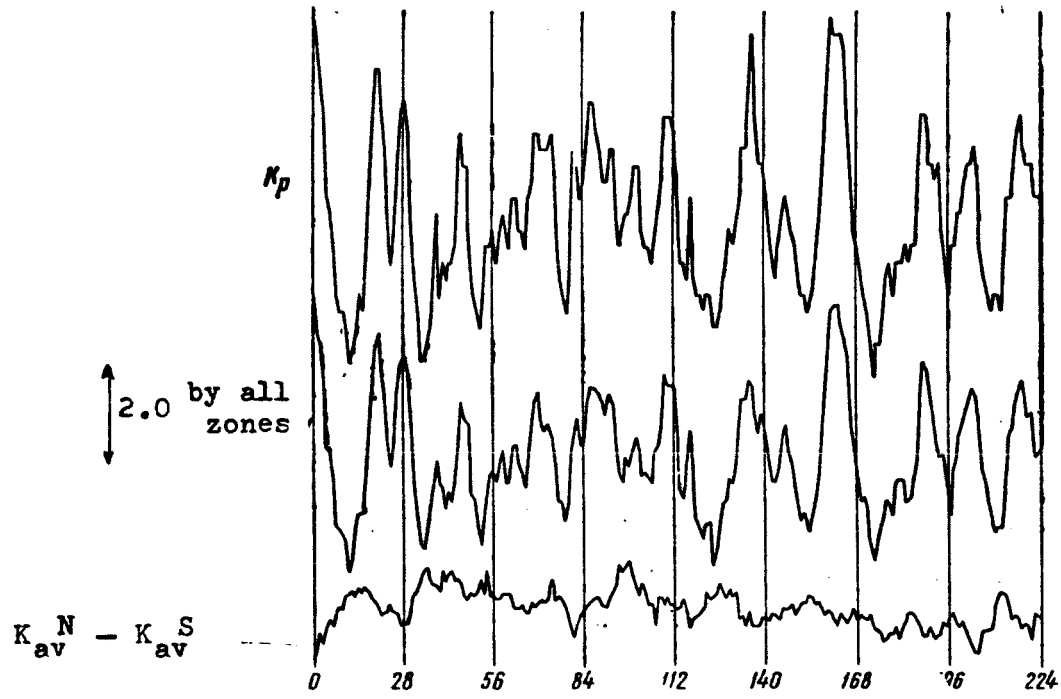

Fig. 1

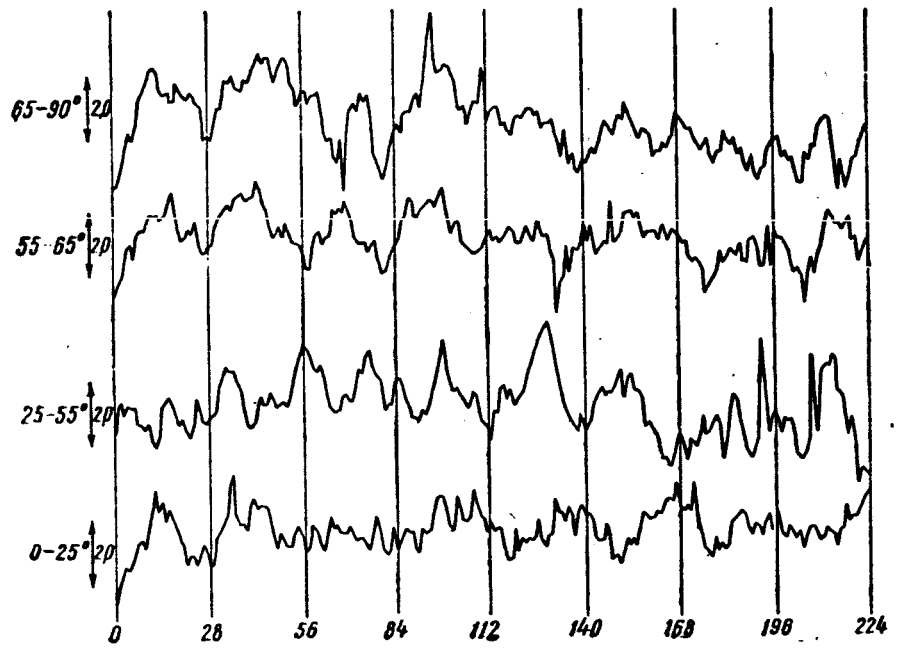

Fig. 2

We plotted in Fig. 2 the difference curves for the 27-day variations of the K-indices of the respective "conjugate" latitude zones $K^N - K^S$.

Analysis of the curves of Fig. 1 shows that the effect of Sun's rotation on planetary characteristics of K_p-indices does not differ essentially from that in the K-indices according to the 17 selected stations. An analogous pattern of K-index behavior is observed in all zones, with the exception of the aurora zone. In the latter (Fig. 2, 55 — 65°) we may observe a correlation of the 27-day variations of K-indices with the corresponding intensity variations of cosmic rays [5] during a period significantly greater than with planetary characteristics of the geomagnetic field disturbance by K_p.

Comparison of the data obtained with the results of the works [2 — 5, 8] shows the following:

1.- The 27-day variations of K_p-indices are expressed significantly less sharply than the 27-day variations of cosmic rays.

2.- The 27-day variations of the H-component of equatorial stations reflect about the same pattern of variations as the 27-day variations of the K_p-indices.

3.- A sharp correlation of the 27-day variation of the geomagnetic field disturbance in the aurora zone with the 27-day variations of cosmic rays is observed.

It should be noted once more, that according to [3], a seasonal variation is observed of the 27-day variation of the Z-component of the geomagnetic field in polar regions; it is apparently linked with the orientation of the respective regions of the geomagnetic field relative to direction of motion of the magnetic inhomogeneities of the solar wind.

Thus, the most sensitive indicator of solar wind, to a significant degree adequate to cosmic rays, is the characteristic of geomagnetic field disturbance in the aurora zone.

**** THE END ****

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